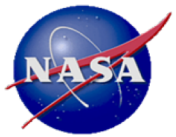
Generating the CDF files for the LSM OL Run

Step-4



In this presentation ...

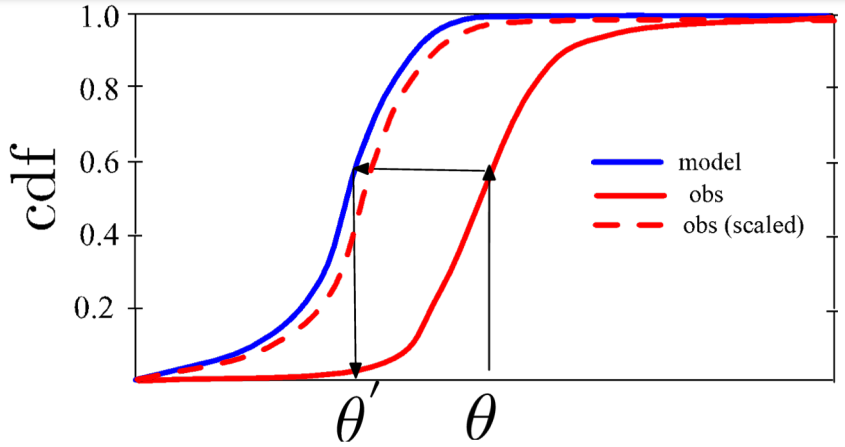
- We present an overview of using LDT to generate the LSM- based cumulative density function (CDF) file.
- CDF-based scaling for bias-correction during soil moisture data assimilation.
- Examining the ldt.config file contents.
- Running this LDT case.

Running LDT: Our Testcase Overview

- Next, we will use LDT to generate files that support scaling and bias-correction between the model open-loop states and satellite observations that we will assimilate in Step 6.
- LDT supports the generation of domain and statistical moment inputs for estimated cumulative density functions (CDFs), which can be used in performing the scaling when assimilating certain observations in LIS.
- The model-based CDF files generated in this step and those generated in Step 5 for the satellite observations will be incorporated then in Step 6, the data assimilation run.

CDF-based scaling background and files

Match the cumulative distribution function (CDF) of the observation to that of the model.



CDFs and CDF-based scaling are performed separately for each grid point

CDF-based scaling corrects all moments of the distribution regardless of its shape (normal deviate based scaling corrects the first and second moments

Need enough sampling density in deriving these scaling parameters

Reichle, R. H. and R. D. Koster (2004), Bias reduction in short records of satellite soil moisture, *Geophysical Research Letters, 31*, L19501, doi:10.1029/2004GL020938.

Download necessary files to run this step …

1) Download the "*Step 4*" tarred-gzipped file from the LIS testcases webpage ("*testcase4_ldt_lsmcdf.tgz*").
2) Unpack the testcase files into your working directory, `$WORKING_DIR`,
3) Once unpacked, you will see the following directories and files:

- `DA_proc_LSM` ➔ Contains all the files below;
- `ldt.config.noah36_cdf` ➔ The LDT config file for this step
- `target_ldtlog.0000` ➔ The "target" LDT log file;
- `target_cdf_noah36_domain.nc` ➔ "target" LDT generated Noah LSM domain file;
- `target_cdf_noah36.nc` ➔ "target" LDT generated Noah LSM CDF file;
- `noah36_cdf.xdf` ➔ GrADS description file that can be used to view cdf_noah36.nc
- `plot_noah36_cdf.gs` ➔ GrADS script that plots an X-Y plot of cdf_noah36.nc

LDT.config file: Setting up and checking entries

First, review the LDT configuration files for our LSM CDF case:

DA_proc_LSM/ldt.config.noah36_cdf

- Copy your LDT executable into the **DA_proc_LSM** directory
- Make sure to understand the settings for the desired model or run mode
- ***For further reference, please check out the LDT User's Guide:***
  https://modelingguru.nasa.gov/docs/DOC-2635

Creating the CDF files for a priori bias correction LSM CDF

Use LDT in the 'DA preprocessing' mode to generate the obs domain and scaling parameters

LDT run domain should reflect the intended observation grid (projection and resolution) – Note that this can be different from the model resolution and projection

A successful completion will generate a 'domain' file: lsm_cdf_domain.nc and lsm_cdf.nc (i.e., cdf_noah36_domain.nc & cdf_noah36.nc)

This will be used as input for the LIS DA run (in Step 6).

```
LDT running mode:                    "DA preprocessing"
```

```
DA preprocessing method:             "CDF generation"
DA observation source:               "LIS LSM soil moisture"
Name of the preprocessed DA file:    "cdf_noah36"
Apply anomaly correction to obs:      0
Temporal resolution of CDFs:         "yearly"   # yearly | monthly
Number of bins to use in the CDF:     100
Observation count threshold:          30
Temporal averaging interval:         "1da"
Apply external mask:                  0
External mask directory:              none
```

```
LIS soil moisture output model name:       "Noah.3.6"
LIS soil moisture output directory:        ../OL_OUTPUT/
LIS soil moisture output format:           "netcdf"
LIS soil moisture output methodology:      "2d gridspace"
LIS soil moisture output naming style:     "3 level hierarchy"
LIS soil moisture output nest index:        1
LIS soil moisture output map projection:   "latlon"
LIS soil moisture domain lower left lat:    34.375
LIS soil moisture domain upper right lat:   39.625
LIS soil moisture domain lower left lon:   -102.875
LIS soil moisture domain upper right lon:  -96.125
LIS soil moisture domain resolution (dx):   0.25
LIS soil moisture domain resolution (dy):   0.25
```

Running LDT - DA preprocessing Step

- Run the ***LDT*** executable with the Noah-3.6 LSM CDF config file:

  LDT ldt.config.noah36_cdf

- Should take a couple of minutes to run …
- Check our *ldtlog.0000* file …. Tail ldtlog.0000
  - What message do you see at the bottom of the log file?
  - Do you see the message: “**Finished LDT run**” ?

    Yes ⇒ *Great job!*

Checking the final CDF output file

- You can plot the CDF netcdf file, using GrADS and files provided:

1) grads -l

2) plot_noah36_cdf.gs

→ You should be able to plot the following graph shown on the right ➔

3) quit